The Porphyrin Ring Experiments

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BRINGING LIFE TO MARS: A SCIENTIST PROPOSES THAT THE KEY TO LIFE ON MARS MAY NOT BE IN ITS DISCOVERY BUT IN ITS ACTUALIZING.

By Jonathan Elliott, UC Berkeley, PBA University

Porphyrin rings have been described as self-assembling catalyst molecules. [1]

The process of photosynthesis has been described as one used by plants and other organisms to convert light energy into chemical energy that can later be released to fuel the organisms' activities (energy transformation). This chemical energy is stored in carbohydrate molecules, such as sugars, which are synthesized from carbon dioxide and water – hence the name photosynthesis, from the Greek φῶς, phōs, "light", and σύνθεσις, synthesis, "putting together". In most cases, oxygen is also released as a waste product.

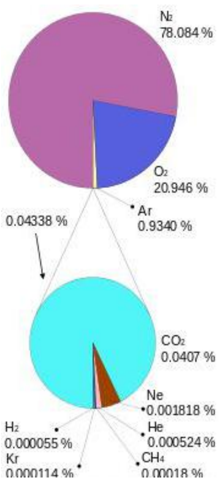
What does that mean on Earth? More then likely, the process of photosynthesis created the atmosphere itself, oxygenating the entire planet for the cycles of life that now populate it. The troposphere is the lowest layer of Earth's atmosphere.

[1] "In nature, chemical reactions are catalysed by several enzymes. (A catalyst is a substance that accelerates a chemical reaction without being consumed in the process). Those catalytic enzymes often employ porphyrins in the active site for the catalytic function. One example is the enzyme Cytochrome P-450 that can catalyse oxidation reactions. In the laboratory for Organic Chemistry (University of Nijmegen) artificial, bio-inspired catalysts are developed that also consist of porphyrins. Each molecule contains 12 porphyrins (a dodecamer) that are bound to a central core molecule. These giant molecules have the shape of a disc (diameter: 38 Å = 3.8 nm) and the molecular weight (15 kDa) is comparable to that of small proteins.

By their specific design, these porphyrin dodecamers have self-assembling properties. On carbon-coated copper grids these molecules form micro-meter sized, stable, solid rings. Supramolecular interactions between the porphyrins (so-called pi-pi-stacking) are the driving force to form these structures. The rings were imaged and investigated by transmission (TEM)- and scanning electron microscopy (SEM). Besides, the precise orientation of the individual molecules within the rings was determined by applying polarized fluorescence microscopy (Pol-Fluo); the different colors of the emitted light correlate with the orientation of the molecules. The aggregation of the molecules into stacks has been visualized by scanning tunneling microscopy (STM; surf to the Scanning Probe Microscope). (Research project of Marga Lensen) Source: http://www.vcbio.science.ru.nl/en/fesem/applets/porphyrin/

By volume, dry air contains 78.09% nitrogen, 20.95% oxygen,[1] 0.93% argon, 0.04% carbon dioxide, and small amounts of other gases. Air also contains a variable amount of water vapor, on average around 1% at sea level, and 0.4% over the entire atmosphere. Air content and atmospheric pressure vary at different layers, and air suitable for use in photosynthesis by terrestrial plants and breathing of terrestrial animals is found only in Earth's troposphere and in artificial atmospheres.

Although variations do occur, the temperature usually declines with increasing altitude in the troposphere because the troposphere is mostly heated through energy transfer from the surface. The troposphere contains roughly 80% of the mass of Earth's atmosphere. The troposphere is denser than all its overlying atmospheric layers because a larger atmospheric weight sits on top of the troposphere and causes it to be most severely compressed. Fifty percent of the total mass of the atmosphere is located in the lower 5.6 km (18,000 ft) of the troposphere.



COMPOSITION OF EARTH ATMOSPHERE

Mars is reported to have varying temperatures between 70 degrees F minus 200 degrees.

The Martian atmosphere consists of approximately 96% carbon dioxide, 1.9% argon, 1.9% nitrogen, and traces of free oxygen, carbon monoxide, water and methane, among other gases.

ICE ALGAE AND LIFE ON OUR PLANET

“The disappearing sea ice is a symptom of a warming planet, and it is also a problem for organisms associated with the ice, such as algae that live in the brine-filled channels within sea ice. ‘These algae are adapted to grow under very low light conditions,’ says Doreen Kohlbach of the Alfred Wegener Institute in Bremerhaven, Germany.”

Source:
https://www.sciencenews.org/blog/wild-things/sea-ice-algae-drive-arctic-food-web

We now know that ice algae play a much more important role for the pelagic food web than previously assumed. This finding also means, however, that the decline of the ice could have a more profound impact on Arctic marine animals, including fish, seals and ultimately also polar bears, than hitherto suspected," says Doreen Kohlbach.

The AWI researcher was able to establish the close relationship between zooplankton and ice algae using fatty acids as biomarkers, which are passed on unchanged in the food chain. The typical fatty acids in ice algae are thus indicators of whether an animal has ingested carbon from ice algae via food. In order to precisely determine the proportion of ice algae carbon in the diet, Doreen Kohlbach also performed an isotope analysis of these biomarkers. The scientist took advantage of the fact that ice algae inherently have a higher

proportion of heavy carbon isotopes incorporated in their cells than algae that float freely in the water. On the basis of the ratio of heavy to light carbon isotopes in the biomarkers it is possible to determine the exact proportion of carbon derived from ice algae in the organisms along the food web."

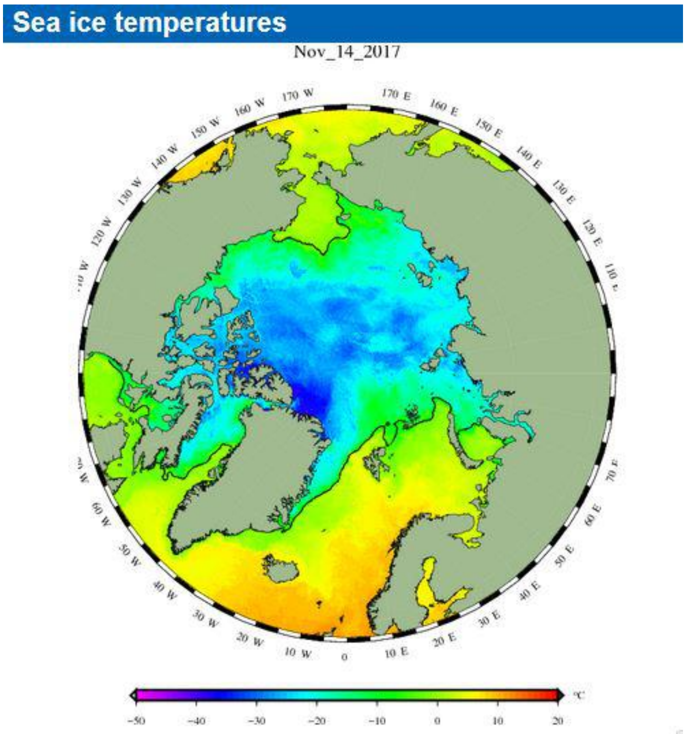
Source:

https://www.awi.de/nc/en/about-us/service/press/press-release/ice-algae-the-engine-of-life-in-the-central-arctic-ocean.html

"While global warming has affected the whole planet in recent decades, nowhere has been hit harder than the Arctic. This month, temperatures in the high Arctic have been as much as 36 degrees above average, according to records kept by the Danish Meteorological Institute."

"Not only is the Arctic Ocean producing more algae, but it's doing so sooner each year. 'These blooms are coming earlier, sometimes two months earlier,' said Mati Kahru, an oceanographer at the University of California, San Diego.

The average temperature of Ice Algae is now being closely monitored.

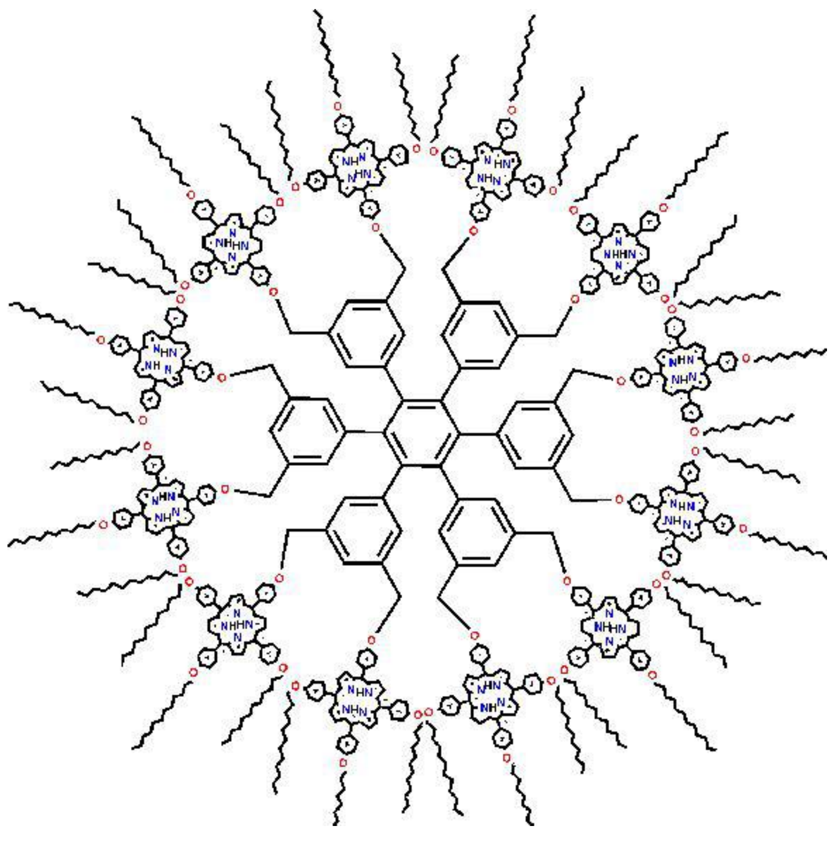


“In April-May 1986, sea-ice microalgae (southcastern Hudson Bay, Canadian Arctic) were acclimated to temperatures ranging from-1.5° to 10°C for short periods (3 h), after which photosynthesis and carboxylating enzyme activities were measured. Pmaxbincreased after acclimation to 10°C while photosynthetic parameters α, β and Ik as well as activities of PePC and PePCk did not show any significant change after temperature acclimation. Contrary to Pmaxb, the activity of RuBPC was lower for algae acclimated to 3°-10°C, the observed response increasing with temperature.” *Photosynthetic Responses of Arctic Sea-ice Microalgae to Short-term Temperature Acclimation*, Michel, C., Legendre, L., Therriault, JC. et al. Polar Biol (1989) 9: 437. https://doi.org/10.1007/BF00443230

I find that while, at a conversion of .33 degree Fahrenheit for Celsius, the range of temperature necessary for the survival of arctic algae *is currently* beyond the actual atmospheric conditions of Mars, cloning studies conducted in Berkeley of local strawberries(Fragaria ananassa Duchesne) were begun and patches of newly developed clones were developed to strategize the prevention of freezing in extremely cold winters. I can still recall my walks home from campus and wondering “What are all these strawberries?” and the local scientists, smiling with their gardening hoses telling me “we are trying to prevent freezing man!”

Anyway, I do believe that even given a .04% cabon dioxide content in the Martian atmosphere, that fact coupled with he advancement made in genetic engineering to improve the survivability of porphyrin algae, may one day make spectacular advancements of life forms possible on Mars.

A caveat here, Porphyrin**,** any of a class of water-soluble, is nitrogenous biological pigments, see, for instance the expressions of Radboud University Nijmegen):



That given the 78.09% figure of Nitrogen content on Mars,
the possibility that"out of control" development of the biological form could happen and that containment during the exploration phase of the planet should be a gradual step by step approach that focuses on the natural development of the species and maintaining the equipment and facility to avoid jeopardizing the colonization process that must advance in terms of the International Space Station and with International Co-Operation.

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